

Survey Studies on Disease Intensity of Club Root of Crucifer against different Brassica Germplasms in different Parts of Plain and Darjeeling Hill of West Bengal

Seteng Baskey¹ Sahar Murmu² and Debashis Rana³

^{1,3}Department of Plant Pathology, BCKV, Mohanpur, Nadia-741252, West Bengal, India

²Survey Selection and Mass production of Nodule Bacteria, BCKV,

Mohanpur, Nadia-741252, West Bengal, India

E-mail: sahar murmu@gmail.com

Abstracts—Clubroot disease of crucifers caused by soil borne obligate biotrophic pathogen *Plasmodiophora brassicae* (Woronin) is a devastating disease of oilseed Brassicas and Cole vegetables. At present Club root diseases is the major and only constraint for rape and mustard cultivation particularly in acidic soil regions of West Bengal. Conventional methods can be applied to manage the disease like soil ameliorating agent-liming to increase soil pH in sick soil. But these practices were found not effective in all the places. Development of resistant variety is very urgent. Therefore survey was done on different Brassica germplasms in plains and Darjeeling hills of West Bengal to identify Brassica germplasm possessing resistance to *P. brassicae*. Least susceptible Rayosak (*Brassica juncea* ssp. *rugosa*), Cauliflower (*Brassica oleracea*) and most susceptible cabbage (*Brassica oleracea*) were observed in different areas of Kalimpong subdivision (Table 3). Cauliflower was found medium susceptible among Cole vegetables at Upper Dugra S. P. Singh Seed Production Nursery. Among the oil seed Brassicas Yellow sarson (B-9) and Tori sarson (Agrani) (*Brassica rapa*) were observed with least and highly disease intensity at Sarenga and Sonamukhia in Bankura district respectively (Table 4). Yellow sarson (B-9) and Local yellow sarson (Jhumka) (*Brassica rapa*) showed medium disease intensity in the plains of South Bengal districts. Black sarson and Indian mustard (*Varuna*) were found with medium and high susceptibility in Hoogly district respectively. From this experiment it was found that there was no complete resistant germplasm of Brassica oil seed and cole vegetables against the club root disease. Therefore it is essential to develop resistant cultivars through breeding programme using exotic resistant variety.

Keywords: Brassica germplasms, Club root, *Plasmodiophora brassicae*, soil pH, variety.

1. INTRODUCTION

Plasmodiophora brassicae (Woronin) is an important soil borne pathogen causing Club root disease of oilseed Brassicas and Cole vegetables. This disease is particularly prevalent in temperate region under diverse soil environmental stress

condition and at present it is reported from all the continents of the world. In India, Club root is known to occur since 1952 and has spread on cabbage in the Darjeeling Hill in Eastern Himalayan region of West Bengal (Chattopadhyay and Sengupta, 1952). Since early 80's when extensive cultivation of rape and mustard started in West Bengal this disease was spreading at alarming rate on rape and mustard specially in acidic soil regions i.e. red and lateritic region and Terai region of West Bengal (Laha *et al.*, 1985). At present Club root diseases is the major and only constraint for rape and mustard cultivation particularly in acidic soil regions of West Bengal state where crop loss even reached up to 100% and farmers have to stop cultivation of rape and mustard in endemic areas. Most popular widely cultivated Yellow Sarson cultivar B-9 (*Brassica rapa*) has been found to be highly susceptible. There is a wide difference of virulence and aggressiveness pattern of the pathogen population within the field and between the club root infested fields in different Agro-Climatic regions of West Bengal state. Conventional methods used to manage the disease are application of soil ameliorating agent like liming to increase soil pH, Calcium Cyanamide- a pesticides cum cyanamide nitrogenous fertilizers, various forms of soil amendments like Boron, Molybdenum, and cultural practices like soil solarization and composting in sick soil. These management practices were found not effective in all the places. Therefore, development of resistant variety is very urgent. There are very few resistant varieties of Brassica vegetables and oilseed Brassicas commercially available in world market. Therefore our objective of this study was to identify Brassica germplasm possessing resistance to *P. brassicae* pathotypes of West Bengal based on field screening.

2. METHODS AND MATERIALS:

The activities which were essential for this study were described as follows.

Analysis of Soil pH:

Sick soil was collected from different parts of North-South Bengal and Darjeeling hills during survey and their pH analysis was made in the laboratory of the Department of Soil Science and Agricultural Chemistry in Bidhan Chandra Krishi Viswavidyalaya, Mohanpur, Nadia, 741252 under the supervision of Dr. P. K. Patra, to find out favourable soil pH against this disease.

Table 1: Characterization of Sick Soils

Sl. No.	Location	Soil pH
	Plain of South Bengal	
1	Nalhati (Birbhum) Lohapur	6.5
2	Bolpur (Birbhum)	6.5
3	Sonamukhi (Bankura)	5.6
4	Sarenga (Bankura)	5.7
5	Khargram (Murshidabad)	6.6
6	Polva(Hooghly)	6
	Darjeeling hills (Kalimpong Subdivision)	
7	Lower Taschdin	6.2
8	Upper Dunga Chisopani, 11 th Mile	6
9	R.R.S. (Hill zone) areas	6.5
10	Upper Dunga S. P. Singh Seed Production Nursery	6.5

Survey was done on different *Brassica* hosts in different parts of south Bengal and hill region of West Bengal against the club root disease of crucifer. These are listed in the following table.

Table no. 2: Tested *Brassica* hosts

Sl. No.	Brassica hosts used	Crops
1	Brassica oleracea group	Cabbage, Cauliflower and Broccoli
2	Brassica rapa group	Yellow sarson(Binoy),Torri sarson(Agrani) and Local yellow sarson(Jhumka)
3	Brassica juncea group	Indian mustard(Varuna), Black Sarson and Rayosak
		Radish(White radish) Raphanus sativus

Disease assessment:

After 45-50 days, the plants were removed from the plots and the roots were washed to free the soil particles and visually rated for club root severity on a 4-point scale as follows:

0= no visible root gall ;

1= less than 10% roots visibly galled;

2= between 10 and 50% of roots visibly galled;

3= greater than 50% roots visibly galled.

The percentage of disease index (PDI), as used by Dobson et al. (1983),was calculated for each host and used to assign a host reaction type (resistant DI=0, indeterminate 0<DI<33 and susceptible DI ≥ 33).

The Disease index (DI) was calculated using the 4-point scale according to the following formula:

$$DI = \frac{[n_0 \times 0] + [n_1 \times 1] + [n_2 \times 2] + [n_3 \times 3]}{N_1 \times 3} \times 100$$

Where, n₀= is the number of plants with a clubroot severity rating 0.

n₁= is the number of plants with a clubroot severity rating 1.

n₂= is the number of plants with a clubroot severity rating 2.

N₁ = number of plants tested.

Result and discussion:

Clubroot disease survey was conducted during 2012-13 covering the different parts of Kalimpong Subdivision including Darjeeling hills and Birbhum, Bankura, Murshidabad, Hooghly and Burdwan districts of South Bengal. It was found that Kalimpong subdivision was the hot spot of the disease, where all the cruciferous plants were susceptible to *Plasmodiophora brassicae*. Rayosak (*Brassica juncea ssp. rugosa*), Cauliflower (*Brassica oleracea*) and cabbage (*Brassica oleracea*) were found the least susceptible at Lower Taschdin and Upper Dunga Chisopani, 11th Mile and most susceptible in higher altitude like Darjeeling hills and Upper Dunga 11th Mile where 70 to 75% cultivated plots infested with club root pathogen (Table 3). Cauliflower was found medium susceptible host among Cole vegetables at Upper Dunga S. P. Singh Seed Production Nursery. Among the oil seed *Brassic*as Yellow sarson (B-9) and Tori sarson (Agrani) (*Brassica rapa*) were observed with least and highly disease intensity at Sarenga and Sonamukhia in Bankura district respectively (Table 4). Yellow sarson (B-9) and Local yellow sarson (Jhumka) (*Brassica rapa*) showed medium disease intensity in the plains of South Bengal districts specially in acidic soil regions like Birbhum, Bankura, Murshidabad, Burdwan. Black sarson and Indian Mustard (Varuna) were found medium and high susceptible hosts in Hoogly district respectively.

Table 3: Club-root disease survey in Darjeeling Hills

Sl. No.	Location Kalimpong Subdivision	Cultivated cruciferous crops	Susceptible / Infected hosts	Type of symptom observed	Disease intensity 0-3 scale	Previous crop Summer/ Kharif / Rabi
	1	2	3	4	5	6
1.	Lower Taschdin	Cauliflower Radish Rayosak, Broccoli	Cauliflower Radish Rayosak, Broccoli	Wilting, small club	1	Cucumber/gourd Bitter crops
2.	Upper Dungra 11th Mile	Cabbage, Rayosak, Cauliflower, Radish, Rape, and Mustard	Cabbage Cauliflower Radish	Severe wilting, clubs on primary & secondary roots	3	Maize/ Soyabean / Cole crops
3.	Upper Dungra Chisopani, 11th Mile	Cabbage, Cauliflower, Rayosak	Cauliflower	Small clubs on secondary roots	1	Paddy/Gladiolus/ cole crops
4.	Upper Dungra S. P. Singh Seed Production Nursery	Cabbage, Cauliflower, and Rayosak	Cauliflower	Slow wilting, small flat type clubs on primary & Secondary roots	2	Gladiolus / Bean/ cole crops
5.	R.R.S. (Hill zone) areas (Kalimpong)	Cauliflower, Rayosak and Radish	Cauliflower Rayosak	Wilting symptom on Cauliflower, compact clubs on primary roots.	3	Cuc umber/ Bhendi / cole crops

Table 4: Club-root disease survey in Plain of South Bengal districts

Location	Cultivated Cruciferous hosts	Susceptible Infected hosts	Symptoms observed	Disease Intensity 0-3 Scale	Previous Crops
Bolpur (Birbhum)	Yellow Sarson (B-9)	Yellow Sarson (B-9)	Small flattened clubs on tap roots	2	Rice
Nalhati(Birbhum) Lohapur	Yellow Sarson (B-9) and Radish	Yellow Sarson (B-9)	Medium size club on tap and branch roots	2	Radish
Sonamukhi (Bankura)	Tori sarson(Agrani), and Radish	Tori sarson(Agrani)	Medium size club on tap and branch roots	3	Rice
Sarenga(Bankura)	Yellow Sarson (B-9)	Yellow Sarson (B-9)	Small clubs on tap roots	1	Rice
Khargram (Murshidabad)	Local Yellow Sarson (Jhumka)	Local Yellow Sarson (Jhumka)	Large size round clubs on tap and branched roots	2	Rice
Polva(Hooghly)	Indian Mustard (Varuna)	Indian Mustard (Varuna)	Large size round clubs on tap and branched roots	3	Rice
Mogra(Hoogly)	Black sarson	Black Sarson	Medium size club on tap root	2	Rice
Memari (Burwdan)	Yellow Sarson (B-9)	Yellow Sarson (B-9)	Small irregular clubbing on tap root	2	Rice

Conclusion:

Club root disease is a devastating disease of oilseed Brassica and Cole vegetables in plains and hill region of West Bengal specially in acidic region. It was not possible to control the disease completely by conventional methods in different places. Therefore identification of resistant Brassica germplasm is very essential to continue their cultivation. But from this survey studies it was found that any oil seed Brassica germplasm and cole vegetables were not found completely resistant in all the places of south Bengal and kalingpang subdivision in acidic region. Therefore it is necessary to develop resistant germplasm through breeding programme

using exotic variety or interbreeding programme because of some germplasm (oil seeds and cole vegetables) showed least disease intensity in some places at plain and hilly region.

References:

- [1] Chattopadhyay, S. B. and Sengupta, S. K. (1952). Addition to the fungi of Bengal. *Bulletin Society Bengal (India)* 16:2-6.
- [2] Dobson, R. L., Robak, J., and Gabrielson, R. L. (1983). Pathotypes of *Plasmodiophora brassicae* in Washington, Oregon, and California. *Plant Disease*, **67**, 269-271.
- [3] Laha, J. N., Naskar, I. and Sharma, B. D. (1985). A new record of clubroot disease of mustard. *Current Science* 54:1247.